

**UNIVERSITI TEKNOLOGI MARA**

**PERFORMANCE OF LAMINATED OIL  
PALM VENEER LUMBER (LOPVL) BONDED  
USING UF, MUF AND PF ADHESIVES**

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Thesis submitted in fulfillment of the requirements  
for the degree of  
**Master of Science**

**Faculty of Applied Sciences**

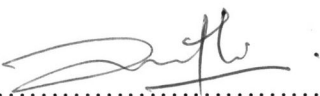
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## **ABSTRACT**

### **PERFORMANCE OF LAMINATED OIL PALM VENEER LUMBER (LOPVL) BONDED USING UF, MUF AND PF ADHESIVES**

By

**Zulhazmi Bin Ahmed**

Oil palm trunk (OPT) has the potential to be converted into lumber, panels and composites products. However, the result on some of the attempted product was not satisfying compared to wood in term of its strength, durability and textures. This is due to the existence of vascular bundles and parenchyma in the OPT. Therefore this study has attempted to continue the effort by producing laminated veneer lumber (LVL) from OPT and define it as laminated oil palm veneer lumber (LOPVL). The main part of the study was the segregation of oil palm veneer according to stem parts: (i) bottom or top section and (ii) peripheral or core region. In the experiment, four types of mechanical tests were being conducted: (i) edgewise horizontal shear, (ii) flatwise horizontal shear, (iii) edgewise bending and (iv) flatwise bending while for adhesion test, three type of water soak test have been conducted: (i) cold, (ii) hot and (iii) boiling. The test parameters were (i) laminations (BPVTCV, TPVBCV, BCV and TCV) and (ii) adhesives (UF, MUF and PF). Based on the delamination test conducted (cold/ boiling water: 24 hours soaking time, hot water: 2 hours soaking time), it was discovered that all samples showed good bonding result using UF, MUF and PF adhesives. All samples passed the delamination test with 0% delamination ratio. From the mechanical test results, it can be concluded that the strength performance of the LOPVL is justified. The application of different lamination and adhesive significantly affect the overall performance of the LOPVL. As the result, lamination BPVTCV has demonstrated the highest performance compared to lamination TPVBCV, BCV and TCV on UF adhesive (HSSed: 4.58MPa HSSfd: 3.84MPa, MORed: 38.2MPa MORfd: 41.0MPa, MOEed: 6111.2MPa MOEfd: 5625.9MPa) and PF adhesive (HSSed: 4.42MPa HSSfd: 3.66MPa, MORed: 31.9MPa MORfd: 37.9MPa, MOEed: 5482.7MPa MOEfd: 5337.2MPa). Based on this result, it was therefore recommended that the best lamination for making the LOPVL is BPVTCV. Further, the LOPVL could be bonded using either UF or MUF for interior application purposes or PF for exterior application purposes.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

In its early history, oil palm was first introduced into Malaysia in 1870 through the Botanic Gardens in Singapore. The industry only began in 1917 and in 1960's it has become one of the great achievements for the country as largest producer and exporter of palm oil (Faridah, 1990; Ashari *et al* 1991; Khozirah and Choon, 1991).

The first experimental planting was carried out in 1903 at Batu 3, Selangor. As a result, in 1911 and 1912, about 15 acres of palms of Deli origin were established in the experimental plantation at Rantau Panjang, Kuala Selangor by the Agricultural Department. In 1914, three varieties from Nigeria were planted in the same plantation and in 1922, selected seeds and seedlings from the Departmental plantation were planted in Serdang station. Oil palm was in full bearing by 1917 with the first and second commercial planting at Tennamaran and Elmina Estates, Kuala Selangor respectively (Bunting *et al*, 1934; Said, 1986).

Nowadays, oil palm plantation in Malaysia covers 3.78 million hectares of area consisting 2.20 million hectares in the peninsula and 1.58 million hectares in Sabah and Sarawak. From this plantation area, the industry was able to gain about RM 26 148.0 million of export value from palm oil, palm kernel oil, palm kernel cake, oleochemicals, finished and other by products (MPOB, 2004).

However, on the other side of this tremendous income lies a transparent dilemma in the industry. This dilemma refers to the abundance of oil palm trunks and fronds generated after the replanting program. These so called "wastes" were generated for every 25 years within the economic life span of the oil palm. During this period, the oil palm will reach its maximum maturity and becomes un-economical for fruit production. Therefore, replanting was definitely un-avoidable for the industry.

In the beginning of the 80's our country seem to change its perspective on this oil palm trunk or OPT. A lot of research and development have been carried out by